



Tennessee Valley Authority, Post Office Box 2000, Soddy Daisy, Tennessee 37384-2000

November 13, 2015

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

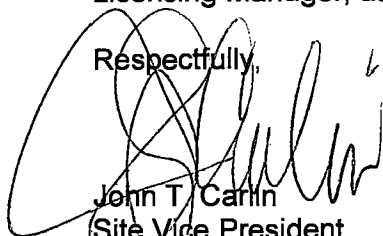
Sequoyah Nuclear Plant, Unit 1
Renewed Facility Operating License No. DPR-77
NRC Docket No. 50-327

Subject: Licensee Event Report 50-327/2015-003-00, "Manual Reactor Trip due to Loss of Power to the Vital Inverter Power Board 1-II"

The enclosed Licensee Event Report provides details concerning a manual reactor trip following a loss of power to the Vital Instrument Power Board 1-II. This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv)(A), as an event that resulted in a manual or automatic actuation of the Reactor Protection System and the Auxiliary Feedwater System. This condition had no impact on Unit 2.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact Jon Johnson, Acting Sequoyah Site Licensing Manager, at (423) 843-8129.

Respectfully,



John T. Carlin
Site Vice President
Sequoyah Nuclear Plant

Enclosure: Licensee Event Report 50-327/2015-003

cc: NRC Regional Administrator – Region II
NRC Senior Resident Inspector – Sequoyah Nuclear Plant

IE22
NRR

**LICENSEE EVENT REPORT (LER)**(See Page 2 for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollections.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME

Sequoyah Nuclear Plant Unit 1

2. DOCKET NUMBER

05000327

3. PAGE

1 OF 6

4. TITLE

Manual Reactor Trip due to Loss of Power to the Vital Instrument Power Board 1-II

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER	
09	14	2015	2015	003	00	11	13	2015	NA		
9. OPERATING MODE											
11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)											
1			<input type="checkbox"/> 20.2201(b)			<input type="checkbox"/> 20.2203(a)(3)(i)			<input type="checkbox"/> 50.73(a)(2)(i)(C)		<input type="checkbox"/> 50.73(a)(2)(vii)
			<input type="checkbox"/> 20.2201(d)			<input type="checkbox"/> 20.2203(a)(3)(ii)			<input type="checkbox"/> 50.73(a)(2)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(viii)(A)
			<input type="checkbox"/> 20.2203(a)(1)			<input type="checkbox"/> 20.2203(a)(4)			<input type="checkbox"/> 50.73(a)(2)(ii)(B)		<input type="checkbox"/> 50.73(a)(2)(viii)(B)
			<input type="checkbox"/> 20.2203(a)(2)(i)			<input type="checkbox"/> 50.36(c)(1)(i)(A)			<input type="checkbox"/> 50.73(a)(2)(iii)		<input type="checkbox"/> 50.73(a)(2)(ix)(A)
100			<input type="checkbox"/> 20.2203(a)(2)(ii)			<input type="checkbox"/> 50.36(c)(1)(ii)(A)			<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)		<input type="checkbox"/> 50.73(a)(2)(x)
			<input type="checkbox"/> 20.2203(a)(2)(iii)			<input type="checkbox"/> 50.36(c)(2)			<input type="checkbox"/> 50.73(a)(2)(v)(A)		<input type="checkbox"/> 73.71(a)(4)
			<input type="checkbox"/> 20.2203(a)(2)(iv)			<input type="checkbox"/> 50.46(a)(3)(ii)			<input type="checkbox"/> 50.73(a)(2)(v)(B)		<input type="checkbox"/> 73.71(a)(5)
			<input type="checkbox"/> 20.2203(a)(2)(v)			<input type="checkbox"/> 50.73(a)(2)(i)(A)			<input type="checkbox"/> 50.73(a)(2)(v)(C)		<input type="checkbox"/> OTHER
			<input type="checkbox"/> 20.2203(a)(2)(vi)			<input type="checkbox"/> 50.73(a)(2)(i)(B)			<input type="checkbox"/> 50.73(a)(2)(v)(D)		Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT

Donald V. Goodin

TELEPHONE NUMBER (Include Area Code)

423-843-6651

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
E	EE	JS	G080	Y					

14. SUPPLEMENTAL REPORT EXPECTED☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO**15. EXPECTED SUBMISSION DATE**

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On September 14, 2015, at 0426 Eastern Daylight Time, Sequoyah Nuclear Plant (SQN) Unit 1 reactor was manually tripped due to a loss of power to the Vital Instrument Power Board (VIPB) 1-II. Prior to the reactor trip, operators were in the process of realigning Vital Inverter 1-II for planned maintenance. During this evolution, VIPB 1-II became de-energized. Operators entered Abnormal Operating Procedure AOP-P.03, "Loss of Unit 1 Vital Instrument Power Board" which required a manual reactor trip. Following the reactor trip, operators restored power to VIPB 1-II with the normal supply at 0550. All plant safety systems responded as designed, all control rods fully inserted, and auxiliary feedwater automatically initiated from the feedwater isolation signal as expected. It was determined that an Alternating Current (AC) output switch failed causing the loss of power to the VIPB 1-II. The direct cause of the switch failure was due to increased friction of bearing surfaces caused by lack of appropriate lubrication. The lack of lubrication was related to a failure to implement a corrective action following an operating experience review at SQN in 2000 of a similar event at McGuire Nuclear Station. The failure to implement a corrective action was determined to be the root cause of this event. Corrective actions to prevent recurrence include ensuring the existing requirement for management review of all corrective action closures remains in the Corrective Action Program. Unit 2 was unaffected by this event.

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Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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NARRATIVE**I. Plant Operating Conditions Before the Event**

At the time of the event, Sequoyah Nuclear Plant (SQN) Unit 1 reactor was operating at 100 percent rated thermal power (RTP). The condition described in this LER did not impact SQN Unit 2.

II. Description of Events**A. Event:**

On September 14, 2015, at 0426 Eastern Daylight Time (EDT), SQN Unit 1 reactor was manually tripped due to a loss of power to the Vital Instrument Power Board (VIPB) 1-II [EIS Code EE]. Prior to the reactor trip, operators were in the process of realigning Vital Inverter 1-II [EIS Code INVT] for planned maintenance. During this evolution, the VIPB 1-II became de-energized. Operators entered Abnormal Operating Procedure AOP-P.03, "Loss of Unit 1 Vital Instrument Power Board" which required a manual reactor trip. Following the reactor trip, operators restored power to VIPB 1-II with the normal supply at 0550. All plant safety systems responded as designed, all control rods fully inserted as required, and auxiliary feedwater automatically initiated from the feedwater isolation signal as expected.

The manual trip was in response to an alternating current (AC) output switch (EIS Code JS) failure that occurred on the Vital Inverter 0-II. This failure resulted in the loss of power to VIPB 1-II. The switch failure occurred due to increased friction of bearing surfaces caused by lack of appropriate lubrication.

B. Status of structures, components, or systems that were inoperable at the start of the event and contributed to the event:

There were no inoperable structures, components or systems that contributed to this event.

C. Dates and approximate times of occurrences:

The event occurred during the realignment of the Vital Inverter 1-II for planned maintenance. The realignment involved placing Vital Inverter 0-II into service to feed the VIPB 1-II. During the realignment, VIPB 1-II lost power. The loss of power required entry into Technical Specification (TS) Limiting Condition of Operation (LCO) 3.8.2.1 and a manual reactor trip in accordance with AOP-P.03. Following the manual reactor trip, power was restored to the VIPB 1-II.

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Dates and Times	Description
September 14, 2015 at 0102 EDT	Clearance approved for placing Vital Inverter 0-II into service as an alternate feed to VIPB 1-II.
September 14, 2015 at 0405 EDT	Vital Inverter 0-II placed into service to the VIPB 1-II.
September 14, 2015 at 0421 EDT	Loss of power to VIPB 1-II occurred.
September 14, 2015 at 0423 EDT	TS LCO 3.8.2.1 entered due to loss of VIPB 1-II.
September 14, 2015 at 0426 EDT	Unit 1 reactor manually tripped as directed by AOP-P.03.
September 14, 2015 at 0550 EDT	VIPB 1-II restored to normal power supply.

D. Manufacturer and model number of each component that failed during the event:

The failed component was an AC molded case output switch on Vital Inverter 0-II. The switch failure led to a loss of power to the VIPB 1-II. The switch manufacturer is General Electric (GE), part # TQD22Y225.

E. Other systems or secondary functions affected:

There were no other systems or functions affected by this event.

F. Method of discovery of each component or system failure or procedural error:

Observations and functional testing of the 0-II vital inverter identified erratic operation of the 0-II AC inverter output switch. The output switch exhibited failure to latch and stay latched during bench testing. It was concluded that this switch failure resulted in the loss of the VIPB 1-II and subsequent manual reactor trip.

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G. The failure mode, mechanism, and effect of each failed component, if known:

The failed component for this event is the vital inverter 0-II output switch. The switch failed to latch and stay latched due to increased friction of bearing surfaces caused by lack of appropriate lubrication.

H. Operator actions:

Upon receipt of multiple alarms, bi-stables lit, rods stepping in, and the centrifugal charging pump suction valve from the refueling water storage tank open, the operators verified no runback was in progress and placed the rod control system in manual. Operators entered AOP-P.03, "Loss of Unit 1 Vital Instrument Power Board," tripped the reactor, and entered Emergency Procedure E-0 "Reactor Trip or Safety Injection," while continuing in AOP-P.03. The operators then transitioned to Emergency Subprocedure ES-0.1, "Reactor Trip Response." Following the reactor trip, operators restored power to VIPB 1-II with the normal supply.

I. Automatically and manually initiated safety system responses:

Following the manual reactor trip, plant safety systems responded as designed. All control rods fully inserted as required. Auxiliary feedwater automatically initiated from the feedwater isolation signal as expected.

III. Cause of the event

A. The cause of each component or system failure or personnel error, if known:

The direct cause of the event was failure of the output switch on Vital Inverter 0-II. This output switch failed open causing loss of power to the VIPB 1-II resulting in entry into AOP-P.03 directing a manual reactor trip.

B. The cause(s) and circumstances for each human performance related root cause:

The root cause was determined to be failure to implement a corrective action from SQN's review of an operating experience event in 2000. The root cause is documented in condition report (CR) 1081482.

IV. Analysis of the event:

SQN Unit 1 reactor was manually tripped in response to loss of power to VIPB 1-II on September 14, 2015. The loss of power was due to a failed AC output switch on Vital Inverter 0-II. The switch failed due to increased friction of bearing surfaces caused by lack of appropriate lubrication.

The plant transient response including reactor power, reactor coolant system (RCS) pressure, RCS temperature, pressurizer level, RCS secondary side pressure, and AFW flow remained within technical specification limits and were bounded by the Updated Final Safety Analysis Report (UFSAR) analysis. Containment pressure, temperature, and radiation were unaffected by this

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transient. Steam generator level experienced during this event was bounded by UFSAR analysis. The plant responded as expected for the conditions of the trip.

Observations and functional testing of Vital Inverter 0-II identified erratic operation of the 0-II AC inverter output switch. The output switch exhibited failure to latch and stay latched during bench testing. No other discrepancies were identified with the inverter. It was concluded that this switch failure resulted in the loss of VIPB 1-II and the subsequent manual reactor trip.

V. Assessment of Safety Consequences

There were no safety consequences as a result of the event. Safety systems functioned as designed and no complications were experienced. No Technical Specification limits were exceeded and the UFSAR analyses of the event remained bounding.

A. Availability of systems or components that could have performed the same function as the components and systems that failed during the event:

There were no other components that could have performed the same function as the vital inverter 0-II AC output switch.

B. For events that occurred when the reactor was shut down, availability of systems or components needed to shutdown the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident:

This event did not occur when the reactor was shut down. Safety-related systems that were needed to shut down the reactor, maintain safe shutdown conditions, remove residual heat or mitigate the consequences of an accident remained available throughout the event.

C. For failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from discovery of the failure until the train was returned to service:

There was no failure that rendered a train of a safety system inoperable during this event.

VI. Corrective Actions

Corrective Actions are being managed by TVA's corrective action program under CR 1081482.

A. Immediate Corrective Actions:

- Vital Inverter 1-II reenergized and placed back into service feeding the VIPB 1-II. Trouble shooting was initiated. Testing was performed on the inverter, AC output switch, cabling, and the transfer switch on the VIPB.
- Initial troubleshooting and testing identified the failed open AC output switch. No other issues were identified.

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- Extent of condition was initiated to identify any other molded case switches with GE Part # TQD22Y225.

B. Corrective Actions to Prevent Recurrence or to reduce probability of similar events occurring in the future:

Ensure the existing requirement for management review of all corrective action closures remains in the Corrective Action Program by "source noting" this requirement in TVA's CAP procedure. The requirement for management review of corrective action closures has been in effect since 2012. Had this requirement been in effect in 2000, the event described in this LER could have been prevented.

VII. Additional Information

A. Previous similar events at the same plant:

A review of the previous reportable events for the past 3 years at SQN found no similar events caused by failure to implement corrective actions from operating experience events. A review of reportable events back to 1994 found one similar vital inverter switch failure that occurred during a maintenance activity. It was also a GE TQD22Y225 switch. This resulted in LER 50-327/94016 and the cause was attributed to mechanical failure.

B. Additional Information:

Institute of Nuclear Power Operations operating experience item OE11056 documented a reactor trip at McGuire in 2000 following a vital inverter output switch failure. A SQN review of this OE failed to implement a corrective action that could have prevented the event described in this LER. Due to the similarities in OE and the failures attributed to this specific component, TVA is planning to formally screen the component failure under 10 CFR Part 21.

C. Safety System Functional Failure Consideration:

This event did not result in a safety system functional failure in accordance with 10 CFR 50.73(a)(2)(v).

D. Scrams with Complications Consideration:

This event did not result in an unplanned scram with complications.

VIII. Commitments:

None.